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Part I: Overview of Business

- ❖ POET began with the purchase of a foreclosed ethanol plant in Scotland, SD in 1987.
- ❖ POET now operates 28 plants in 7 states, including 6 plants in IA.
- ❖ POET is the largest producer of ethanol in the United States.

Every year, a POET 60 million gallon ethanol plant is expected to...

- Provide a market for approximately 21 million bushels of corn
- Produce 60 million gallons of ethanol
- Produce 178,000 tons of Dakota Gold® DDGS, a high quality and nutritious animal feed
- Create approximately 40 jobs
- Provide an annual payroll of about \$1.8 million
- Drive revenues of restaurants, hotels, entertainment and other businesses

(attributed to <https://poet.com/>)

“The Problem”

Chemistry and physics principles are used all over the POET plant. In all aspects of the process you’re talking about separation techniques (distillation, centrifugation, molecular sieves, etc.), thermodynamics and energy conservation with boilers, heat exchangers & the cooling tower, and applications of pressure with tanks, piping, etc., just to name a few. In the quality lab you’re looking at sifting and filtration accompanied by NIR (near-infrared) spectroscopy and HPLC (high-pressure liquid chromatography) analysis to name a couple.

The “problem” I chose to focus on is how the boiler room techs use chemistry to assess the “health” of the water in the plant, whether it’s potable (drinkable) or from the boilers or cooling tower. There are many chemical tests performed to see whether many aspects of the water quality are within specs for those various uses.

Business Solution:

POET would actually address water quality issues by having the boiler room operators run a regular series of tests and seeing if they are within specifications for the various chemicals. They are testing for nitrate and chlorine levels in the plant potable water, as well as sulfite and alkalinity to assess the health of the boilers.

Background Knowledge

The students would need these skills and background knowledge in order to do this project.

Knowledge of making measurements with various lab equipment including graduated cylinders and burets

Basic titration principles

Using “Graphical Analysis” to take readings using a colorimeter

Following lab procedures

Student “solutions”

My intent with this particular project is not for the students to come up with a “solution”, but to emulate the job of the boiler technicians. It’s basically a quantitative analysis lab modeled on real-world application.

1. Students will be given water samples, told where it is from, what it’s purpose is, and be given some SOPs (standard operating procedures) to work from.
2. The students need to determine what tests to perform, follow the procedure to do the test, and certify whether the water is within accepted levels (which will be provided to them)